A preliminary search for *Epioblasma torulosa rangiana* (Northern Riffleshell) in the Maitland River watershed

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ABSTRACT

Epp, J. M., T. J. Morris, and K. A. McNichols-O'Rourke. 2013. A preliminary search for *Epioblasma torulosa rangiana* (Northern Riffleshell) in the Maitland River watershed. Can. Manuscr. Rep. Fish. Aquat. Sci. 3025: v + 19 p.

Surveys of the freshwater mussels (Unionidae) of the Maitland River were conducted by Fisheries and Oceans Canada in 2012 in order to evaluate the presence/absence of *Epioblasma torulosa rangiana,* a federally and provincially Endangered species. Eleven sites were sampled along the main channel of the Maitland River, in the portion of the watershed. A total of 461 animals were found, representing 11 species. The dominant species in the Maitland River watershed was *Lampsilis cardium* (Plain Pocketbook), which occurred at all sites surveyed and represented 32% of all mussels found. Two federally and provincially listed mussel Species at Risk, *Villosa iris* (Rainbow) and *Lampsilis fasciola* (Wavyrayed Lampmussel), were detected. A total of nine *L. fasciola* were found at five sites, whereas *V. iris* occurred at all but three sites and represented 26% (119 of 461) of all mussels found. No live *E. t. rangiana* or shells were discovered during surveys.

RÉSUMÉ

Epp, J. M., T. J. Morris, and K. A. McNichols-O'Rourke. 2013. A preliminary search for *Epioblasma torulosa rangiana* (Northern Riffleshell) in the Maitland River watershed. Can. Manuscr. Rep. Fish. Aquat. Sci. 3025: v + 19 p.

En 2012, Pêches et Océans Canada a effectué des relevés des moules d'eau douce qui se trouvent dans la rivière Maitland afin d'évaluer la présence ou l'absence de la dysnomie ventrue jaune (*Epioblasma torulosa rangiana*), une espèce reconnue comme étant en voie de disparition à l'échelle fédérale et provinciale. Des échantillons ont été prélevés dans 11 sites le long du chenal principal de la rivière Maitland, dans la section du bassin versant. En tout, 461 animaux ont été découverts, représentant 11 espèces différentes. L'espèce dominante dans le bassin versant de la rivière Maitland était la lampsile cordiforme (*Lampsilis cardium*), qui était présente à tous les sites échantillonnés et représentait 32 % de toutes les moules trouvées. Deux espèces de moules inscrites sur les listes fédérale et provinciale des espèces en péril, la villeuse irisée (*Villosa iris*) et la lampsile fasciolée (*Lampsilis fasciola*), ont été repérées. En tout, neuf *L. fasciola* ont été trouvées à cinq sites; pour sa part, *V. iris* était présente à tous les sites, sauf trois, et constituait 26 % (119 sur 461) de l'ensemble des moules découvertes. Aucune *E. t. rangiana* vivante ou coquille n'a été trouvée pendant les relevés.

1.0 INTRODUCTION

Freshwater mussels are one of the most imperilled faunal groups (Williams et al. 1993). North America supports the greatest diversity of freshwater mussels in the world, yet approximately 72% of all species require conservation efforts and 12% of known species are presumed to be extinct (Williams et al. 1993; Ricciardi et al. 1998). In Canada there are 55 freshwater mussel species, with 41 of those occurring in Ontario (Metcalfe-Smith et al. 2005). In Ontario, 13 species of freshwater mussels are listed as Endangered, Threatened or Special Concern under the federal *Species at Risk Act* (SARA) and the provincial *Endangered Species Act* (ESA; COSEWIC 2013; OMNR 2013). The decline of freshwater mussels throughout North America can largely be attributed to habitat loss, pollution and the introduction of nonindigenous mollusks, namely *Dreissena polymorpha* (Zebra mussels; Williams et al. 1993; Ricciardi et al. 1998). Freshwater mussels play an important role in the functioning of aquatic ecosystems by cleaning water through filtering, cycling nutrients and providing food and habitat for aquatic and terrestrial wildlife (Metcalfe-Smith et al. 2005; Vaughn and Hakenkamp 2001). Surveys to determine mussel distributions are vital to ensure the survival and recovery of freshwater mussels.

The Maitland River watershed is located in southwestern Ontario (Figure 1). The river consists of five sub-basins and is under the management of the Maitland Valley Conservation Authority. Beginning at its headwater near the township of Wellington North, the river flows approximately 150 km and enters Lake Huron at Goderich (McGoldrick and Metcalf 2004). The headwaters of the Maitland River flow through till plains whereas the lower river reaches consist largely of clay plains as the river runs along the Wyoming moraine (Chapman and Putnam 1984). Primary land use within the Maitland River watershed is agricultural, with soils generally composed of loams; in particular, clay loam (Hoffman et al. 1952).

The 2012 mussel surveys focused on the Lower Maitland sub-basin between Marnoch and Goderich and were prompted by the findings of two separate weathered valves of *Epioblasma torulosa rangiana* (Northern Riffleshell) in the Lower Maitland River by naturalist T. Lobb in 2011 (Figures 2 and 3). This species is of special significance, as it is one of the last remaining members of a near extinct genus with only four known reproducing populations within North America, including the Ausable and Sydenham rivers (Jones et al. 2006; COSWEIC 2010a). The weathered valves were found over 12 river km apart; a male valve was found 2.8 km south of Benmiller near the Shelter Valley Campground and a second valve was found 4.8 km east of Benmiller just upstream of where the South Maitland River flows into the Lower Maitland River. Prior to this report, there have been no records of *E. t. rangiana*, a federally and provincially Endangered species, in the Maitland River. Extant *E. t. rangiana* populations are currently restricted to the Ausable River and a 50-km reach of the Sydenham, both occurring to the south of the Maitland River (Morris and Burridge 2006). There is very little historical information on the Maitland River, however 11 sites were sampled in 1998 and 2003 by McGoldrick and Metcalfe (2004), and an additional six sites were sampled in 2008 by DFO (unpublished data). Four of these 17 sites were located in the Lower Maitland River. The *E. t. rangiana* valves were found in a section of the Lower Maitland River which has not been previously examined. In addition, the Maitland River is believed to support the largest and healthiest remaining population of

the federally Endangered and provincially Threatened *Villosa iris* (Rainbow) in Canada (COSEWIC 2006). It is also home to a reproducing population of the *Lampsilis fasciola* (Wavyrayed Lampmussel; COSEWIC 2010b) which is listed as Special Concern and Threatened by the federal and provincial governments respectively. The presence of other Species at Risk (SAR) mussels within the Maitland River, coupled with the discovery of weathered *E. t. rangiana* valves, indicate that the potential exists for this species to occur within the watershed. Therefore, intensive surveys were conducted in the Lower Maitland River by DFO in 2012 to determine species assemblage composition, richness, abundance and to evaluate the potential existence of an *E. t. rangiana* population.

2.0 METHODS

Eleven sites in the Maitland River watershed were surveyed in July and October 2012 (Figure 1, Appendix A). Each site was surveyed visually using the intensive timed-search technique described by Metcalfe-Smith et al. (2000). At each site the substrate was surveyed to the maximum wading depth using visual (viewing boxes, naked eye) techniques. A team of at least five people moved parallel to the river bank for a total of at least 6 person-hours of searching per site. During the surveys all live animals were removed from the substrate and placed in a mesh diver's bag. At the end of the sampling period, mussels from all collectors were combined, identified, measured, sexed (if possible) and returned to the river.

In addition to the biological data on the mussel community, several physical and environmental variables were also recorded at each site. These variables included substrate composition, water clarity, length of reach, mean stream depth and width. Definitions of substrate sizes were modified from Wentworth (1922): boulder (>250 mm in diameter), rubble (60-250 mm), gravel (20-50 mm), sand (<2 mm) and "other" material (mud, muck, silt, and detritus).

3.0 RESULTS

3.1 ABIOTIC FACTORS

Table 1 provides a summary of the physical data collected during the surveys of the Maitland River. These data are not meant to address issues relating to species microhabitat preferences, but rather to provide a general description of the site and assist future researchers in locating the exact site should further surveys take place. Generally, the majority of the substrate (percent composition) consisted of rubble, gravel and sand with means (± standard error) of 33.7 (± 4.7), 24.2 (± 3.2) and 15.5 (± 2.8), respectively. At least some boulder was located at all sites with a mean of 11.9 (± 2.2); whereas, bedrock was only found at two of the eleven sites with a mean of 11.0 (± 8.1). Water clarity was "clear" (entire water column visible) at all sites throughout the Maitland River. Site length and mean width ranged from 200-625 m and 3-136 m respectively, and mean depth surveyed was 0.49 m. Water temperatures were high during surveys ranging from 25.7°C to 32.3°C.

3.2 FRESHWATER MUSSEL COMMUNITY

A total of 461 animals, representing 11 species, were collected during the Maitland River surveys (Table 2). Total abundance was highly variable; ranging from no individuals at MR-31, to a high of 153 individuals at MR-23 (Table 2). Similar to patterns in abundance, species richness was highly variable across sites ranging from no species at MR-31, to a high of 10 species at MR-30. The two dominant species in the watershed were *Lampsilis cardium* (Plain Pocketbook) and *V. iris* (Table 3). *Lampsilis cardium* was the most widely distributed species, occurring at all sites where mussels were found in the Maitland River. Relative abundance varied from three at MR-28 to 24 at MR-25, indicating it was the most common species (32% relative abundance). Of the 148 *L. cardium* collected, 106 males and 42 females were identified resulting in the male to female ratio of 2.5:1. Figure 4 shows the length frequency distribution for these males and females.

Two mussel SAR, *V. iris* and *L. fasciola,* were observed during the Maitland River surveys. *Villosa iris* was found at eight of the 11 sites and varied in abundance from a single individual at two sites (MR-22, MR-26), to a maximum of 65 (MR-23), making it the second most abundant species (26% relative abundance; Figure 5). Of the 119 *V. iris* found, 71 were identified as males and 47 were identified as females indicating the sex ratio 1.5:1. One individual was not sexed and was therefore excluded from the length frequency distribution (Figure 6). A total of nine *L. fasciola* were found at five sites (MR-06, MR-23, MR-24, MR-25, MR-30), seven were identified as males and two were identified as females. Lengths ranged from 61 to 83 mm, with a maximum male length of 83 mm and female length of 62 mm.

Alasmidonata marginata (Elktoe), a common species, occurred at all but three sites (MR-28, MR-29, and MR-31) and was the third most abundant species (16% relative abundance; Figure 7). The length frequency distributions of 75 *A. marginata* found represents a population that appears to be healthy with multiple size classes, implying positive reproduction and recruitment.

No evidence (live mussels, fresh shells, weathered shells or shell fragments) of *E. t. rangiana* was found during this survey.

4.0 DISCUSSION

The 2012 surveys confirmed the presence of eleven species of mussels in the Maitland River watershed, including two SAR species, *V. iris* and *L. fasciola*, which are known in the Maitland River. No live *E. t. rangiana* or shells were discovered during surveys. The 2012 survey detected all eleven species previously recorded by earlier surveys in the Lower Maitland Watershed, including *Actinonaias ligamentina* (Mucket), which was first recorded in 2008 in the South Maitland River (DFO, unpublished data). The detection of all previously recorded species demonstrates that the current survey was extremely thorough and all expected species in this waterbody were observed during the course of the surveys.

4.1 *Epioblasma torulosa rangiana* (Northern Riffleshell)

Epioblasma torulosa rangiana was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1999 and is protected

under the SARA (COSEWIC 2010a). It is also designated as Endangered by the Ontario Ministry of Natural Resources (OMNR) under the ESA (OMNR 2013). Historically this species occurred in Lake Erie, as well as the Detroit, Sydenham, Ausable and Thames rivers (COSEWIC 2010a). The range of *E. t. rangiana* has seen a 95% decrease from historic records; current populations exist only in the Ausable and Sydenham rivers (Morris and Burridge 2006). One of the main limiting factors for *E. t. rangiana* may be the availability of silt-free, riffle habitat or access to suitable host fishes (COSEWIC, 2010a). Primary host fish for *E. t. rangiana* are *Etheostoma exile* (Iowa Darter) and *Cottus bairdii* (Mottled Sculpin) with marginal host species *Etheostoma nigrum* (Johnny Darter), *Etheostoma caeruleum* (Rainbow Darter), *Percina caprodes* (Logperch), and *Percina maculata* (Blackside Darter; McNichols et al. 2011). In the Maitland River, a primary host, *C. bairdii*, and a marginal host, *E. caeruleum*, are present indicating the potential for reproducing populations of *E. t. rangiana* (DFO unpublished data). The shell remnants found in 2011 represent the first evidence that *E. t. rangiana* has ever occurred in the Maitland River. This survey did not confirm the presence of *E. t. rangiana* in the Maitland River, and no additional shells were discovered during the study. While it is conceivable that the valves collected in 2011 were accidently dropped off by a recreation user (i.e. canoeist, child's sand bucket, shell collector), it is also possible that a very small, unknown population exists in the Maitland River. Evidence for this theory may be supported by the discovery of a small population of *E. triquetra* in 1998 from a 59.7 km reach of the Ausable River and indicates the continual identification of new and unique populations of Unionid mussels in similar waters. Further surveys are required to determine if *E. t. rangiana* occurs in the Maitland River.

4.2 *Villosa iris* (Rainbow)

As previous surveys have shown, *V. iris* was detected in the Maitland River with high abundance. This species was assessed as Endangered by COSEWIC in 2006 and is protected under the SARA. The OMNR designated *V. iris* as Threatened under the ESA (COSEWIC 2011; OMNR 2013). Historically, this species was present in the Ausable, Bayfield, Detroit, Grand, Maitland, Moira, Niagara, Salmon, Saugeen, Sydenham, Thames and Trent rivers, as well as lakes Huron, Ontario, Erie and St. Clair (COSEWIC 2006). Although *V. iris* is still extant in most of these river, it appears to be extirpated from the lower Great Lakes and connecting channels (except for the Lake St. Clair delta; COSEWIC 2006). The range of *V. iris* has decreased by 30% in Canada with the primary cause being attributed to the invasion of *D. polymorpha*, as well as pollution from both urban and agricultural activities (COSEWIC 2006). The Maitland River appears to be at low risk for invasion by *D. polymorpha* as the river is not navigable by boats, one of the primary vectors for spreading Dreissenid mussel larvae (COSEWIC 2010a; Dalton and Cottrell 2013). Based on size class distribution, this study has confirmed the existence of a reproducing population of *V. iris* in the Maitland River (Figure 6). The Maitland River population is considered the largest and healthiest remaining population of *V. iris* in Canada and is considered vulnerable to threats such as "increasing industrial agriculture and intense livestock practices" (COSEWIC 2006). Continued surveys are required to monitor abundance and reproduction of *V. iris* in this waterbody.

4.3 *Lampsilis fasciola* (Wavyrayed Lampmussel)

Lampsilis fasciola was originally assessed as Endangered in 1999 and was recently down listed to Special Concern under the SARA based on findings in the 2010 COSEWIC status report of new populations and densities (COSEWIC 2010b). It is currently designated as Threatened by the OMNR under the ESA (OMNR 2013). Historically this species occurred in the Ausable, Detroit, Grand, Maitland, Sydenham and Thames rivers as well as Lake Erie and Lake St. Clair and can currently be found in all but the Sydenham River, Detroit River and Lake Erie. *Lampsilis fasciola* populations in Ontario are showing signs of improvement with observed increases in population estimates, relative abundances and area of occupancy since the initial listing as Endangered in 1999 (COSEWIC 2010b). *Lampsilis fasciola* has been found in all previous surveys of the Maitland River; in 1935 by Oughton, 1998 by Metcalfe-Smith, 2003 by McGoldrick and Metcalfe, and 2008 by Morris (COSEWIC 2010b). Surveys conducted following the 1999 listing led to the discovery of a large, reproducing population in the Maitland River (COSEWIC 2010b).

5.0 CONCLUSION

This is the third formal survey of mussels in the Maitland River watershed. As such, it adds to the baseline data collected in previous years and is useful for presence/absence and species richness comparisons. Further surveys are required to determine if *E. t. rangiana* exists in the Maitland River at sites where access may be difficult, as well as continuing to monitor populations of *V. iris* and *L. fasciola*.

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Table 1. Physical characteristics of the sites surveyed in the Maitland River watershed in 2012. Substrate types are modified from Wentworth (1922): boulder is >250 mm in size, rubble is between 60-250 mm in size, gravel is between 20-50 mm in size, and sand is <20 mm in size. "Other" includes bedrock, muck, mud, silt, and detritus. N/A refers to data that were not collected.

Site	Substrate (%)						Water clarity	Water Temperature (°C)	Site length (m)	Mean width (m)	Mean depth searched (m)	Stream morphology (%)		
	Bedrock	Boulder	Rubble	Gravel	Sand	Other						Riffle	Run	Pool
MR-06	0	20	55	15	5	5	Clear	N/A	200	3	0.6	0	0	100
MR-22	0	10	60	15	15	0	Clear	28.2	200	22	0.5	N/A	N/A	N/A
MR-23	0	5	35	30	30	0	Clear	32.3	366	20	0.4	40	0	60
MR-24	0	20	35	30	10	5	Clear	31.7	350	30	0.75	N/A	N/A	N/A
MR-25	0	5	35	30	20	10	Clear	26.6	202	60	0.5	N/A	N/A	N/A
MR-26	0	5	35	35	20	5	Clear	27.6	400	33	0.3	N/A	N/A	N/A
MR-27	0	10	30	35	20	5	Clear	29.9	410	33	0.5	N/A	N/A	N/A
MR-28	36	26	26	11	1	0	Clear	32.3	500	30	0.4	N/A	N/A	N/A
MR-29	0	15	25	30	25	5	Clear	25.7	450	100	0.5	N/A	N/A	N/A
MR-30	0	10	35	30	20	5	Clear	26.8	460	100	0.4	N/A	N/A	N/A
MR-31	85	5	0	5	5	0	Clear	29.3	625	136	0.5	N/A	N/A	N/A

Table 2. Numbers of live specimens collected at all sites surveyed in the Maitland River watershed in 2012 by Fisheries and Oceans Canada. MR-31 is not included as no live mussels were present.

Species Name	MR-06	MR-22	MR-23	MR-24	MR-25	MR-26	MR-27	MR-28	MR-29	MR-30	Total
Actinonaias ligamentina	2									1	**3**
Alasmidonta marginata	3	3	28	14	8	3	3			13	**75**
Alasmidonta viridis		1	10	3	12	2		2		7	**37**
Lampsilis cardium	4	18	44	19	24	9	6	3	9	12	**148**
Lampsilis fasciola[1]	1		4	2	1					1	**9**
Lampsilis siliquoidea	3										**3**
Lasmigona compressa					4					2	**6**
Lasmigona costata	25		2	2	1	2		1		3	**36**
Pyganodon grandis				1	14		1			1	**17**
Strophitus undulatus				1	4		2			1	**8**
Villosa iris[1,2]	4	1	65	20	15	1		4		9	**119**
Total	**42**	**23**	**153**	**62**	**83**	**17**	**12**	**10**	**9**	**50**	**461**
Species Richness	**7**	**4**	**6**	**8**	**9**	**5**	**4**	**4**	**1**	**10**	

[1] Protected under the provincial *Endangered Species Act*.
[2] Protected under the federal *Species at Risk Act*.

Table 3. Abundance and frequency of occurrence of all mussel species observed in the Maitland River watershed in 2012.

Species	Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Actinonaias ligamentina	3	0.66	0.18
Alasmidonta marginata	75	16.38	0.73
Alasmidonta viridis	37	8.08	0.64
Lampsilis cardium	148	32.31	0.91
Lampsilis fasciola[1]	9	1.97	0.45
Lampsilis siliquoidea	3	0.66	0.09
Lasmigona compressa	6	1.31	0.18
Lasmigona costata	36	7.86	0.64
Pyganodon grandis	17	3.71	0.36
Strophitus undulatus	8	1.75	0.36
Villosa iris[1,2]	119	25.98	0.73

[1] Protected under the provincial *Endangered Species Act*.
[2] Protected under the federal *Species at Risk Act*.

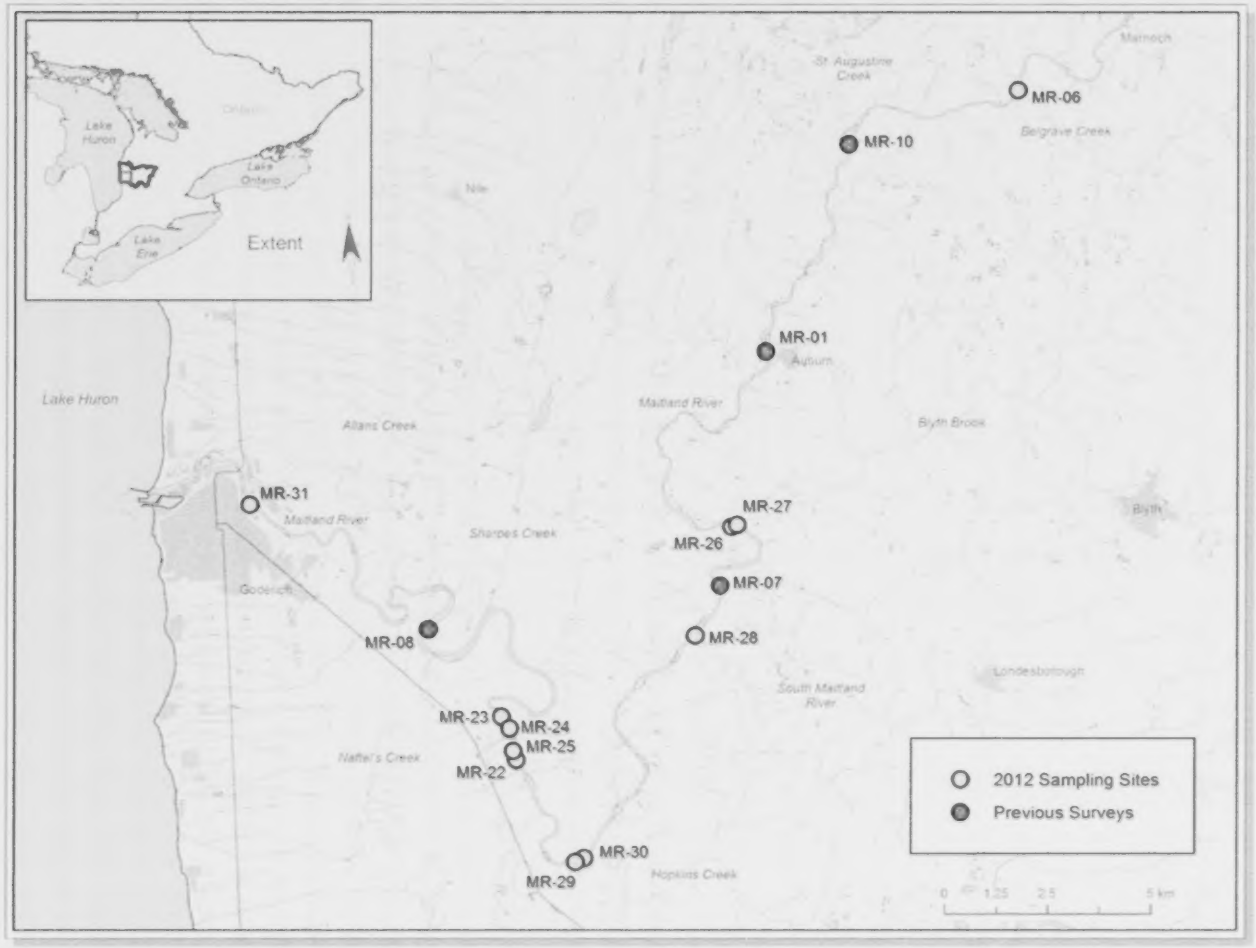

Figure 1. Eleven sites surveyed by Fisheries and Oceans Canada in the Maitland River watershed in 2012 and previous surveys sites from 1998 to 2003. Site number corresponds to numbers in the tables and appendices. Maitland River watershed delineated in purple in inset map.

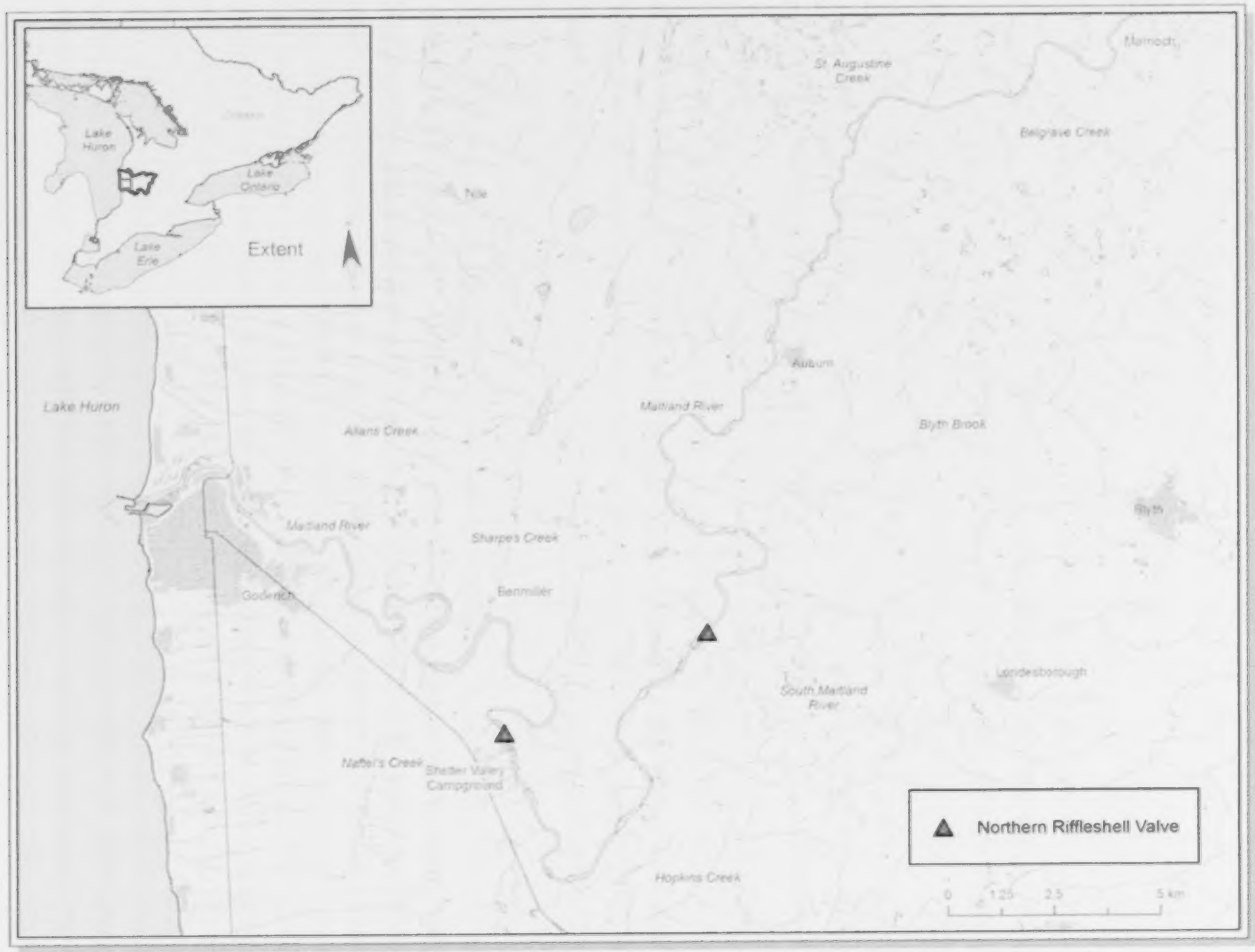

Figure 2. Two sites where single valves of *Epioblasma torulosa rangiana* were found by T. Lobb in 2011. One site is located just north of MR-28 and the other is in-between MR-23 and MR-24. Maitland River watershed delineated in purple in inset map.

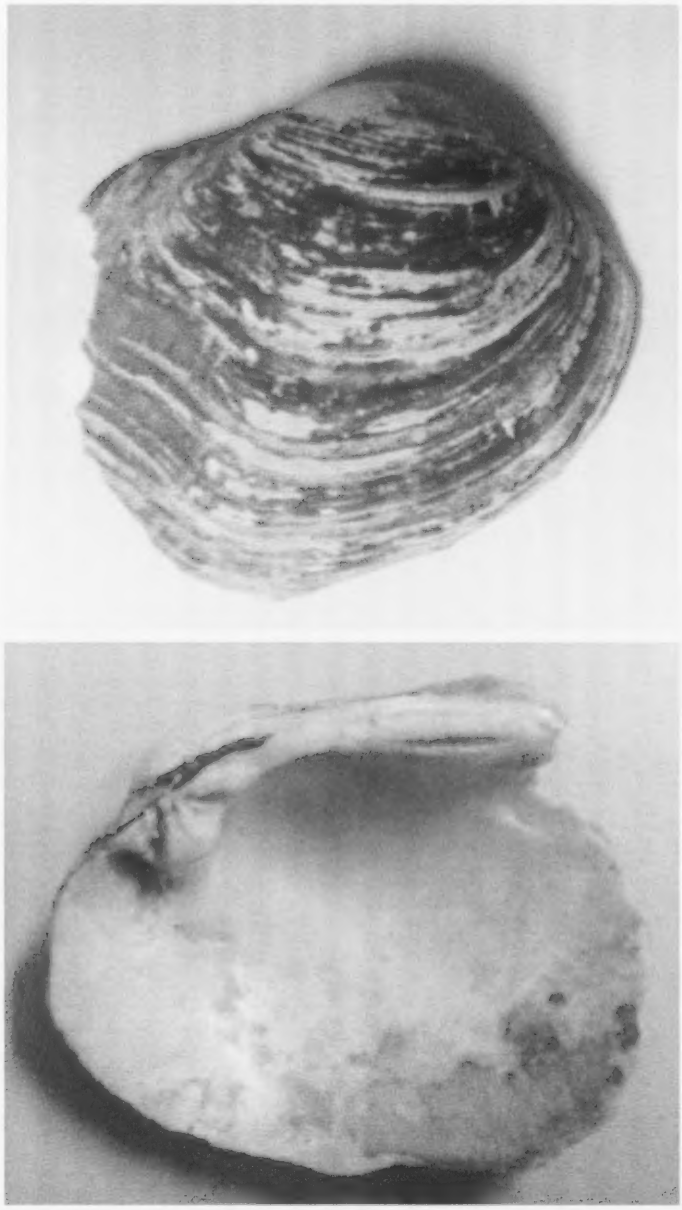

Figure 3. The outside (top) and inside (bottom) of the right valve of a male *Epioblasma torulosa rangiana* (Northern Riffleshell) found by T. Lobb in the Maitland River in 2011.

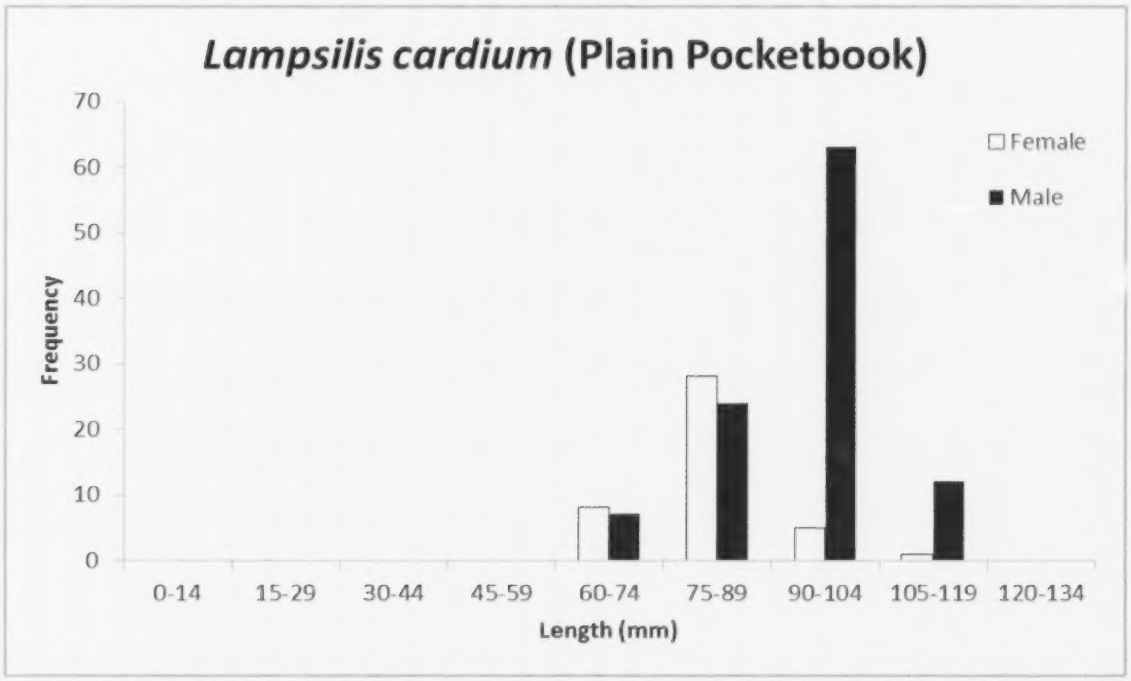

Figure 4. Length frequency distribution for male (106 individuals) and female (42 individuals) *Lampsilis cardium* (Plain Pocketbook) found in the Maitland River watershed in 2012 by Fisheries and Oceans Canada. For details on the number of individuals observed at each site see Table 2.

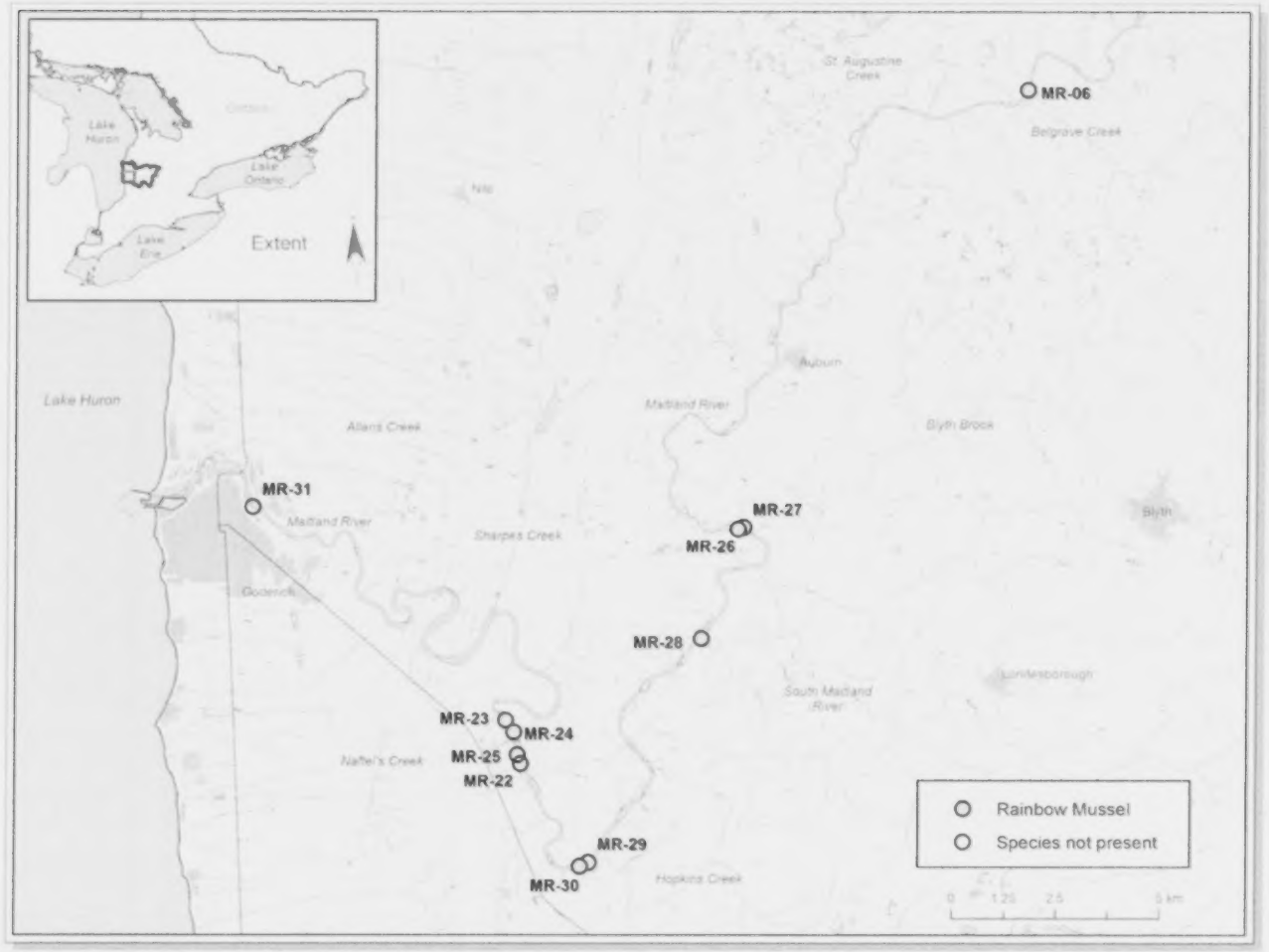

Figure 5. *Villosa iris* (Rainbow) occurrence in the Maitland River watershed during surveys by Fisheries and Oceans Canada in 2012. For details on the number of individuals observed at each site see Table 2. Site number corresponds to numbers in the tables and appendices. Maitland River watershed delineated in purple in inset map.

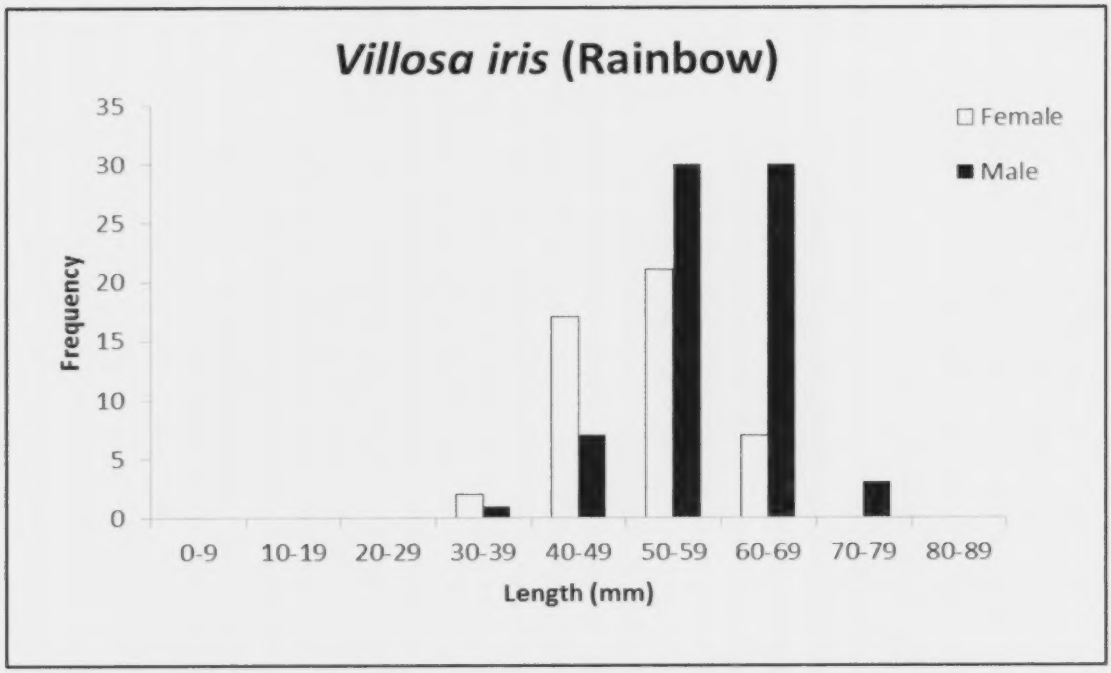

Figure 6. Length frequency distribution for male (71 individuals) and female (47 individuals) *Villosa iris* (Rainbow) found in the Maitland River watershed in 2012 by Fisheries and Oceans Canada. For details on the number of individuals observed at each site see Table 2.

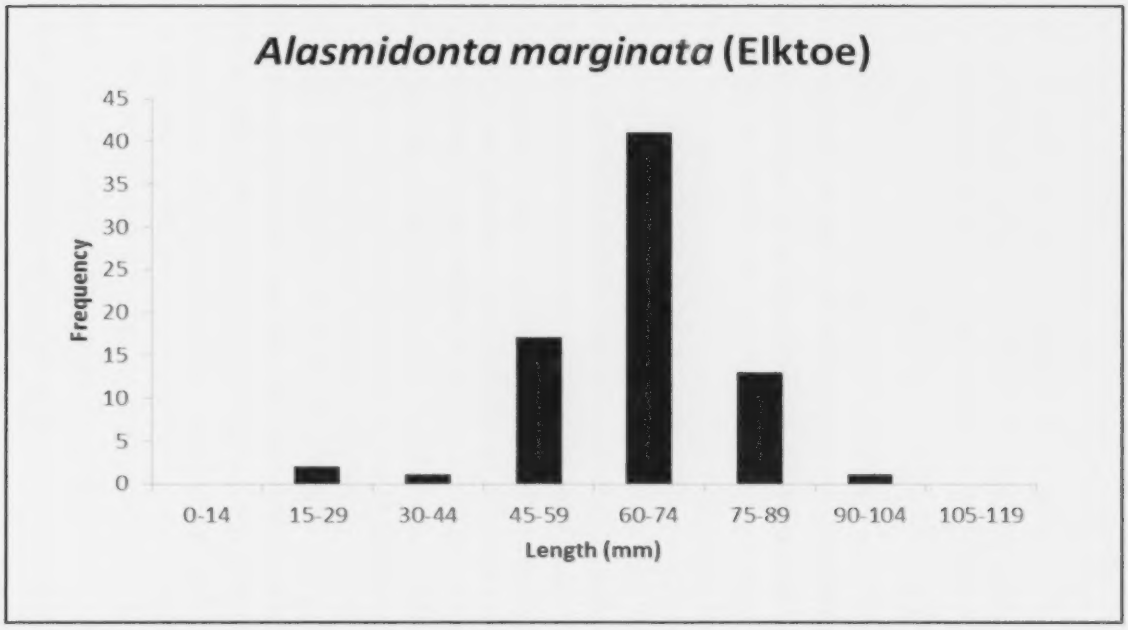

Figure 7. Length frequency distribution 75 individuals of *Alasmidonta marginata* (Elktoe) found in the Maitland River watershed in 2012 by Fisheries and Oceans Canada. For details on the number of individuals observed at each site see Table 2.

Appendix A. Locations of all sites surveyed in Maitland River watershed in 2012 by Fisheries and Oceans Canada. Site descriptions and effort (number of person-hours searched) are included. N/A refers to data that was unavailable.

Site	Date	Latitude	Longitude	Waterbody	Local Description	Effort
MR-06	05/10/2012	43.82958	-81.46072	Maitland River	Wawanosh Valley Conservation Area	N/A
MR-22	16/07/2012	43.68526	-81.62055	Maitland River	Access via Bishop Rd – at end of path	7
MR-23	16/07/2012	43.69503	-81.62442	Maitland River	Access via Bishop Rd – at end of path, second island downstream	7
MR-24	16/07/2012	43.69233	-81.62214	Maitland River	Bishop Rd – at end of path, first island downstream	6.5
MR-25	17/07/2012	43.68727	-81.62143	Maitland River	Bishop Rd – Downstream of river access point	6
MR-26	17/07/2012	43.73489	-81.55285	Maitland River	Maitland Block Rd – access at Blythe-Brook bridge	8
MR-27	17/07/2012	43.73526	-81.55119	Maitland River	Maitland Block Rd – access at Blythe-Brook bridge	7
MR-28	18/07/2012	43.71116	-81.56510	Maitland River	Ball's Rd – Penfound sites	6
MR-29	18/07/2012	43.66294	-81.60146	Maitland River	Sharps Creek Line – upstream of bridge	6
MR-30	18/07/2012	43.66211	-81.60417	Maitland River	Sharps Creek Line – downstream of bridge	6
MR-31	18/07/2012	43.74443	-81.69734	Maitland River	End of Maitland Rd – access via Millennium Trail	6